

## NATURAL RESOURCES CONSERVATION SERVICE

### CONSERVATION PRACTICE STANDARD

## IRRIGATION LAND LEVELING

(Ac.)  
CODE 464

### DEFINITION

Reshaping the surface of land to be irrigated to planned grades.

### PURPOSE

To permit uniform and efficient application of irrigation water to the leveled land.

### CONDITIONS WHERE PRACTICE APPLIES

This standard applies to leveling irrigated land based on a detailed engineering survey, design, and layout. It does not include Precision Land Forming (462) or Land Smoothing (466).

### CRITERIA

Planned work shall comply with all Federal, State, and local laws and regulations.

Land to be leveled shall be suitable for irrigation and for the proposed methods of water application. Water supplies and irrigation deliveries to the area to be leveled shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application method to be used.

Soils shall be deep enough so that after leveling an adequate, usable root zone remains that will permit satisfactory crop production with proper conservation measures. Limited areas of shallower soils may be leveled to provide adequate irrigation grades or a better field arrangement. The finished leveling work must not result in exposed areas of highly permeable materials that can inhibit proper distribution of water over the field. After the planned leveling work is completed, the minimum usable root zone depth for the general area shall not be less than 12 inches

for fine and medium textured soils, 18 inches for moderately textured soils and 24 inches for very coarse textured soils.

All leveling work shall be planned as an integral part of an overall farm irrigation system to enhance the conservation of soil and water resources. The boundaries, elevations, and direction of irrigation of individual field leveling jobs shall be such that the requirements of all adjacent areas in the farm unit can be met.

**Field grades.** If more than one method of water application or more than one kind of crop is planned, the land must be leveled to meet the requirements of the most restrictive method and crop. All leveling work must be designed within the slope limits required for the methods of water application to be used, to provide for the removal of excess surface water, and to control erosion caused by rainfall. Reverse grades in the direction of irrigation shall not be permitted.

**Slope for level irrigation methods.** The maximum fall in the direction of irrigation shall not exceed one-half the design depth of application for a normal irrigation. The difference in elevation across an individual border strip shall not exceed 0.1-feet.

**Slope for graded irrigation methods.** The maximum slope in the direction of irrigation if rainfall erosion is not a significant problem shall be as follows:

1. Furrows - 3 percent,
2. Corrugations - 8 percent,
3. Borders for nonsod-forming crops, such as alfalfa or grain - 2 percent,
4. Borders for erosion-resistant grass or grass-legume crops or for nonsod-forming crops on sites where water application by

the border method will not be required until after good crop stands have been established-4 percent.

5. Contour ditch for sod crops 15 percent.

In areas where potential for rainfall erosion is great, the maximum slope for furrows shall be 0.5 percent and 2 percent for borders for sod forming grasses and 0.5 percent for other crops.

On slopes in the direction of irrigation of more than 0.5 percent where leveling designs provide for increasing or decreasing slopes, the following limits shall apply:

- The maximum slope in an irrigation run shall be no more than twice the minimum.
- The change in slope in any 100-foot reach shall not exceed one-half the maximum permissible change along the length of run. However, short level sections are permissible at the upper or lower ends of irrigation runs to facilitate water control or to reduce runoff.
- The maximum permissible slope change is the difference between the flattest and steepest design slope along the length of run.

**Cross slope.** The maximum cross slope for borders shall be 0.1-feet per border strip width.

The allowable cross slope for furrows and corrugations depends on the stability of the soil, the size of furrows that are to be used, and the rainfall pattern in the area.

TABLE 1

Maximum Recommended Cross-Slope

| Inflection of<br>Downslope   | Fine and<br>Medium<br>Textured Soils | Moderately Coarse<br>and Course<br>Textured Soils |
|------------------------------|--------------------------------------|---|
| Uniform<br>and<br>Increasing | 2/3 of<br>Downslope                  | 1/3 of Downslope                                  |
| Decreasing                   | 1/2 of<br>Downslope                  | 1/4 of Downslope                                  |

Cross slopes must be such that "breakthroughs" from both irrigation water and runoff from rainfall are held to a minimum. The

cross slope shall not exceed the downslope. For downslopes greater than 2 percent the cross slope should not exceed the values listed in Table 1 for the respective soil textures and slope inflections.

For contour ditch irrigation the cross slope shall not exceed 1/4 of the general downslope.

**Slope For subsurface irrigation methods.** In areas where irrigation is practiced through ground water level control, the field surface shall be shaped to parallel the expected subsurface water elevations. The design shall consider the desired depth from the soil surface to the elevation of the ground water.

**Surface drainage.** Farm irrigation systems shall include plans for removing or otherwise controlling excess irrigation and storm water. Leveling designs must provide field elevations and field grades that will permit proper functioning of the planned drainage system facilities.

**Maximum field elevation.** All leveling work shall be designed to permit delivery of needed irrigating streams onto the highest point on the field surface. The field elevation shall be at least 0.33-feet below the water surface elevation at the point of delivery.

## CONSIDERATIONS

In the design consider the excavation and fill material required for or obtained from such structures as ditches, ditch pads, and roadways. The appropriate yardage shall be included when balancing cuts and fills and determining borrow requirements.

Consider related structures and measures needed to control irrigation water and/or storm water runoff.

Consider crops, method of irrigation, soil intake rates, field slope, irrigation stream size and resulting deep percolation and runoff when determining or evaluating length of irrigation runs.

Consider the depth of cuts and the resulting available plant rooting depths to saline soils and to shallow water tables.

In areas with sediment-laden irrigation water, consider increasing the required height of the water surface at the point of delivery.

Consider effects on irrigation efficiencies, especially on volumes and rates of runoff, infiltration, evapotranspiration and deep percolation.

Consider effects on water flows and aquifers, and the affect to other water uses and users.

Consider the effects on adjacent wetlands.

## **PLANS AND SPECIFICATIONS**

Plans and specifications for irrigation land leveling shall be site specific and shall show the requirements for installing the practice to achieve its intended purpose. Site specifics typically include field boundaries, planned cuts and fills, earthwork volumes, cut/fill ratio, direction of irrigation, design down slope and cross slope, required water surface and location of irrigation water delivery, tailwater disposal, and appurtenant structures.

## **OPERATION AND MAINTENANCE**

The maintenance on leveled fields includes the periodic removal or grading of mounds and/or depressions. Land grading may periodically be needed to restore the design gradient.

## **REFERENCES**

- Engineering Field Handbook  
Chapter 15, Irrigation
- National Engineering Handbook  
Section 15, Chapter 3, Planning  
Irrigation Systems  
Section 15, Chapter 4, Borders  
Section 15, Chapter 5, Furrow  
Irrigation  
Section 15, Chapter 6, Contour Levee  
Irrigation  
Section 15 Chapter 12, Land Leveling  
Part 652, Idaho Irrigation Guide